

Rotatoria and Crustacea plankton communities of the feed-water streams of the Lake Balaton

by

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Abstract: The paper deals with the Rotatoria, Cladocera and Copepoda plankton of the 21 streams feeding the Lake Balaton in the period of 1997–1998. Zooplankton studies were completed with detailed water chemical analyses from which only the water quality indices are evaluated herein. Occurrence data are given in an attached list of species according to streams, additionally water quality, faunistic and ecological characteristics are also assessed. Occurrence of 75 Rotatoria, 34 Cladocera and 13 Copepoda, altogether 122 species were recorded during the study.

Keywords: feed-water of the Lake Balaton, water quality, Rotatoria, Cladocera, Copepoda plankton

Introduction

The Hydrobiological Department of the Water Resources Research Center during 1997–1998 conducted a detailed hydrobiological and water chemistry study of 21 small streams feeding the Lake Balaton. The primary aim of the study was to analyze the ecological state of the streams, collection of floristic and faunistic data and the methodological harmonization of the biological water quality assessment methods with the ones applied in the Member States of the EU.

Preliminary studies were carried out between 1992 and 1997, a biomonitoring system was developed that is compatible with that applied in the European Community and takes into account the national monitoring and biodiversity surveys. In this earlier period we have conducted investigations at 48 larger rivers in Hungary when trophic and saprobic parameters, community structure of fito- and zooplankton, as well as the survey of the aquatic macroscopic invertebrate were assessed in this integrated system (Gulyás 1992, 1993, 1997).

No previous survey was ever conducted on the feed-waters of the Lake Balaton from this special respect. The present series of investigations is in harmony with the previous national survey and will represent a solid scientific background for the baseline ecological assessment of these streams to forecast long-term ecological changes. Results of water chemistry and biological investigations were evaluated according to the Hungarian Standards (MSZ 12749). Classification to water quality classes was also based on the principles as prescribed by the Hungarian Standards. This paper is particularly devoted to the assessment of the results of the investigation on the Rotatoria and Crustacea plankton.

On the basis of the results a biological water quality monitoring system can be developed, which can be applied for the monitoring of the future ecological changes of the small streams around the Lake Balaton. Results are indicative of those water quality problems that effect at the present the ecological state of the lake. One of the most important factors amongst these is the nutrient load that enters to the lake via these streams causing eutrophication in the water body. In order to improve the ecological state of the Lake Balaton it is indispensable to have solid background information on the ecological state and biological water quality of the feed-waters of the lake.

Literature survey

The first results of the floristic and faunal investigations of the feed-waters of the Lake Balaton were published at the turn of the century. First publication on the algal flora elements of the Kis-Balaton and lower Zala section appeared also at the end of the past century. Istvánffy (1897) published algological data by analysing samples from several habitats of the Kis-Balaton region including sediment, "foam", and the surface of higher plants as well as fish fries. Francé (1897) published a study on protozoan species that also included the description of microscopic Flagellata alga to our present knowledge from the water of the Kis-Balaton and the southern wetlands of Balaton.

During the fifties the Biological Research Institute of the Hungarian Academy of Sciences, Tihany conducted extensive surveys on the Aszód creek, the Pécsely creek and feed springs, as well as the physiological, hydrological, hydrochemical and hydrobiological state of the small feed-waters of the Balaton (Entz *et al.* 1954, Entz 1958).

Results on the Pécsely creek (= Örvényesi creek) at Örvényes were summarized in a study by Entz *et al.* (1954). The report contains many sections including the analysis of hydrographic conditions, the assessment of planktonic and bentonic algal communities, the communities of the creek, the Rotatoria and other worm species, beetles, Dipterans, Mollusca, fish, epibiotic communities, and the occurrence and ecology of crustacean species, and the biological processes of lime formation.

Hydrographic conditions of the Aszód creek and the distribution and ecology of the aquatic and surface dwelling Hemiptera, and Malacostraca species were described by Lukacsovics (1957, 1958a, b) in several studies.

Varga (1957) identified and described a very rich Rotatoria fauna on the slow-flowing sections of the Aszód creek embedded in *Chara* population and concluded that the surfaces of living and inorganic objects covered by lime are favoring the formation of habitats for the Rotatoria. Highest species richness and individual abundance of Gastrotricha also occurred here, at the sections of rich *Chara* vegetation.

The first comprehensive survey on the water chemistry of the feed-waters of the Balaton was compiled by Entz (1959). This study classified these streams into three basic categories: spring-fed waterways, Balaton and other surface water inlets. Of the large variety of the chemically different waters on the Balaton region is largely due to the diverse geological conditions, acidic water, karstic water, dolomite and basalt springs, springs from Pannonic layers and its karstic types are all occurring in the region. Downstream towards the lake these are becoming more and more similar to the lake water from chemical viewpoint. Surface runoff and mostly precipitation feed water are predominant on the southern shore of the lake, these are usually rich in organic materials (wetlands).

Researches of the water quality of the feed-waters of the Lake Balaton started when the eutrophication of the lake gained attention. Under the supervision of the Inspectorate for Water Quality of the National Water Authority several laboratories started to investigate the water quality (Székesfehérvár, Szombathely, Pécs). In 1970 the regular survey of the water quality of the feed-waters began including the investigations of water chemistry and hydrobiology. The primary aim of these investigations was to assess the eutrophication process and the nutrient loads to the lake. On the basis of the results of the investigation on 17 streams and 16 point sources it was concluded that the surface streams carry 80–90% of the total nitrogen load and 57–96% of the total phosphorus load.

Hydrobiological investigation of the streams at this time only included the evaluation of the saprobio-logical para-meters and the determination of the chlorophyll-*a* contents. The regular measurements have been continued since then within the frame of the national monitoring network but investigations were later completed by new parameters.

Ponyi (1997) summarized the results of the faunistical researches on invertebrates from the turn of the century until now. On the basis of the detailed literature survey he concluded that the organized creek research has started in 1952. It was recognized at this time that the ecological state of the feed-waters intimately relates to the water quality of the lake itself. Further research is needed to investigate to what extent these factors are determined by hydrographical conditions and how the biological water quality of the streams and the lake relates. Further parts of the paper assess in details the results of the most important fauna elements. It emphasizes the relation of the creeks and the Balaton and the priority tasks for their protection.

Material and methods

Water temperature and dissolved oxygen concentrations were measured on-site and the latter was precipitated immediately for the Winkler method. Further chemical analyses were made according to the appropriate Hungarian Standards collected from the surface.

Table 1 summarizes the available flow/discharge data (m^3/sec), for 1997 where the monthly ranges and averages are also given (minimum, maximum and averages). In general it is concluded that the discharge values of most of the streams were below 100 l/sec . Some exception prevails, the Örvényesi creek that has maximum flow in this range and the Tapolca creek with $0.5 \text{ m}^3/\text{sec}$ flow rate and the Zala river with highly variable discharge, occasionally reaching the m^3/sec value.

Table 1. Discharge data of the streams in 1997

No.	Name of stream	06. 1997.			07. 1997.			09. 1997.		
		Flow rate (m³/sec)								
		Min.	Average	Max.	Min.	Average	Max.	Min.	Average	Max.
1	Vörösberényi creek	0,012		0,021		0,024		0,017		0,018
2	Lovasi creek		0,054			0,011			0,015	
3	Csopaki creek		0,013			0,011			0,008	
4	Örvényesi creek	0,089		0,104	0,089		0,101	0,039		0,052
5	Burnót creek	0,051		0,091		0,034			0,030	
6	Egervíz	0,050		0,102	0,061		0,068	0,035		0,458
7	Tapolca creek	0,402		0,440	0,340		0,478	0,264		0,402
11	Zala	3,30	4,94	6,20	4,10	7,46	10,90	1,80	2,37	2,90
12	Nyugati channel		1,312			1,437			0,930	
14	Keleti-Bozót channel		0,902			0,750			0,300	
16	Jamai creek		0,030			0,003			0,001	
17	ABC channel		0,731							
18	Tettes creek	0,055		0,128	0,050		0,397	0,044		0,048
19	Nagymetszés trench		0,072			0,022			0,016	
20	Köröshegyi creek		0,107			0,087			0,043	
21	Endrédi creek		0,033			0,027			0,030	

The creeks and sampling sites are shown in Fig. 1. Zooplankton samples were surface samples, filtered water volume was 50 liters at each of the sampling sites. Filter mesh size was $70 \mu\text{m}$. Filtrate was conserved in Lugol-iodine solution. Determination of the species was conducted by using light microscope in the laboratory. Quantitative studies were made by using Utermöhl-type inverted plankton microscope with 5 ml chamber. For the crustacean investigation the whole sample was used, while in case of the Rotatorians provided that they occurred in large numbers the $1/20^{\text{th}}$ of the sample was analyzed.

Results

1. Vörösberényi creek

The specific electric conductivity varied between $870\text{--}1020 \mu\text{S/cm}$. Higher than average values of salt contents are indicated by the above average Ca^{2+} , and Mg^{2+} , total hardness and HCO_3^- values. On the basis of the inorganic ionic composition the water falls to the beta-limno-type, $\text{Ca} - \text{Mg} - \text{HCO}_3$, and in one occasion to $\text{Mg} - \text{Ca} - \text{HCO}_3$ water type. Indicators of organic pollution COD_{ps} and COD_{k} indicated good water quality. 90% percentile value of the dissolved oxygen was 121.5%, in spite of the fact, that the maximum value of the chlorophyll-*a*

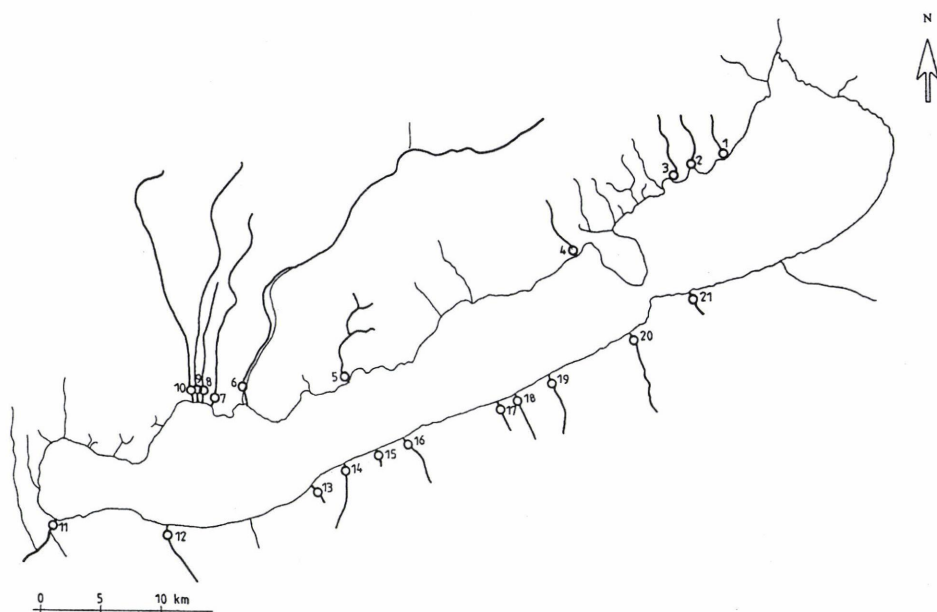


Fig. 1. Sampling sites on creeks flowing to the Lake Balaton, 1997–1998

concentration was only 5.2 $\mu\text{g/l}$. The reason for this could be the high flow velocity (turbulent stream), and the photosynthetic activity of the rich biofilm community. The nitrogen and phosphorus contents of the creek are high, indicating the presence of pollutants.

The Rotatoria and Crustacea fauna of the creek is poor, as indicated by the presence of only 9 taxa. Average individual number varied between 36–99 ind./100 liter. Common species are characteristic to eutrophic waters such as (*Brachionus angularis*, *Euchlanis dilatata*, *Keratella cochlearis cochlearis*, *Alona rectangula*, *Chydorus sphaericus*). No rare species was found.

2. Lovasi creek

The specific electric conductivity of the creek varied between 695–885 $\mu\text{S/cm}$ corresponding to the alpha-oligohalobitic stage. On the basis of the inorganic ionic composition the water falls within the beta-limno-type to the $\text{Mg} - \text{Ca} - \text{HCO}_3$ category, and in one occasion to $\text{Ca} - \text{HCO}_3$ class. Higher than average values of Ca^{2+} -, and Mg^{2+} - as well as hydrogen-carbonate, and total hardness values were measured. Parameters of oxygen budget indicate the presence of organic pollutants that either can be easily or not easily broken down. Of the nitrogen forms the ammonium and nitrite, and phosphorus forms were contributing to the deterioration of water quality during the study. Concentrations of chlorophyll-*a* varied in the range of 1.5–21.0 $\mu\text{g/l}$.

10 Rotatoria and 11 Crustacea species were identified during the study period with variable individual abundance values (22–332 ind./100 l). Primarily the dominance of those species that are living on the submerged aquatic vegetation was observed (*Euchlanis dilatata*, *Lepadella ovalis*, *Platyas patulus*, *P. quadricornis*, *Ceriodaphnia quadrangula*, *Leydigia leydigi*, *Eucyclops serrulatus*, *Macrocyclus albidus*). Occurrence of some euplanktonic species was also recorded (*Brachionus rubens*, *Keratella quadrata*, *Daphnia hyalina*). The species composition and abundance of the zooplankton community was poor of this creek.

3. Csopaki creek

Specific electric conductivity of the Csopaki creek varied between 650–765 $\mu\text{S}/\text{cm}$ corresponding to the alpha-oligohalobic stage. On the basis of the inorganic ionic composition the water falls to beta-limno-type, in general $\text{Ca} - \text{Mg} - \text{HCO}_3$, and in two occasions $\text{Mg} - \text{Ca} - \text{HCO}_3$. Similarly to the previously discussed two creeks the values of the Ca^{2+} -, and Mg^{2+} -, and HCO_3^- as well as the value of the total hardness were slightly higher than the other parameters. The water of the creek is cleaner than the previous ones having better quality as the parameters of the oxygen budget and nutrient indicate good water quality. Worse water quality is only indicated by the oxygen saturation and total phosphorus content values.

Higher species number was observed amongst the Rotatoria assemblages (7), the crustaceans were only represented by 3 Cladocera species. Individual numbers in 100 liters varied only between 20–76. On two occasions of sampling none of the species was present in the sample. Interestingly both for the Rotatorians and Crustaceans, mostly the euplanktonic organisms were found (*Keratella cochlearis tecta*, *K. quadrata*, *K. testudo*, *Lecane bulla*, *Notholca squamula*, *Bosmina longirostris*, *Daphnia hyalina*) in small individual numbers. Most of them are characteristic of slightly polluted or higher trophity waters.

4. Örvényesi creek

The specific electric conductivity varied between 740–810 $\mu\text{S}/\text{cm}$ corresponding to the alpha-oligohalobic stage. On the basis of the inorganic ionic composition the water falls to beta-limno-type with characteristic $\text{Ca} - \text{Mg} - \text{HCO}_3$ composition, and in one occasion $\text{Mg} - \text{Ca} - \text{HCO}_3$. Ca^{2+} -, Mg^{2+} - and HCO_3^- concentrations as well as the total hardness values are identical to the Csopaki creek. Chemical oxygen demand values are indicating organic pollution. Dissolved oxygen contents and oxygen saturation values indicate, however, good water quality. The plant nutrient concentration of the creek, the nitrogen and phosphorus concentration is excessive. In spite of the high nutrient contents, the chlorophyll-*a* value is low (max. 8.9 $\mu\text{g}/\text{l}$). The creek is characterized the bentonic eutrophication and the tectonic algae are dominant.

Rotatoria and Crustacea fauna of the creek is poor, similar to the previously described creeks. Individual abundance values were ranging only 32–100 ind./100 liter. Identified species were nearly identical, some more rare species were recorded (*Brachionus quadridentatus quadridentatus*, *Testudinella parva*). On two occasions of sampling none of the species was present in the sample, similarly to the previous creek.

5. Burnót creek

Specific electric conductivity values of the creek corresponded to alpha-oligohalobic, or oligo-mesohalobic stages. On the basis of the inorganic ionic composition the water falls within the beta-limno-type to the $\text{Mg} - \text{Ca} - \text{HCO}_3 - \text{SO}_4$, $\text{Ca} - \text{Mg} - \text{SO}_4 - \text{HCO}_3$ and $\text{Mg} - \text{Ca} - \text{HCO}_3$ category. Inorganic ionic composition varied at all the sampling occasions, but the sulfate represented a good portion of the equivalent percentage. Dissolved oxygen value indicate good, while the oxygen saturation and COD values bad water quality. Nitrogen- and phosphorus concentrations are indicating moderately polluted creek water. 90% percentile of the chlorophyll-*a* content was 12.0 $\mu\text{g}/\text{l}$.

Four Rotatoria species were only found in April 1998 (*Brachionus angularis*, *Keratella cochlearis cochlearis*, *K. c. tecta*, *K. quadrata*), and one Cladocera species (*Macrothrix hirsuticornis*) and some nauplius larvae. Abundance values were characteristically higher than of the previous streams indicating higher trophic status. In spite of the occurrence of these species, this creek cannot be classified.

6. Egervíz

The minimal value of specific electric conductivity indicates alpha-oligohalobic and oligo-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type, usually $\text{Ca} - \text{Mg} - \text{HCO}_3$, or $\text{Ca} - \text{Mg} - \text{HCO}_3 - \text{SO}_4$ character. Ionic composition, concentrations and measured values only slightly differed from the values of Burnót creek. Difference was only observed in lower oxygen saturation and lower chlorophyll-*a* contents (90% percentile was 6.2 µg/l). The reason for this is the already mentioned benthic eutrophication.

During the investigation of the zooplankton 15 Rotatoria, 3 Cladocera and 2 Copepoda species was registered, abundance values were always low. The dominant species was *Euchlanis dilatata* as species composition varied to a large extent in each sampling series. Rare species were also identified here living in the biotecton: *Brachionus quadridentatus quadridentatus*, *Paradicranophorus hudsoni*, *Ptygura melicerta*, *Eucyclops speratus*, *Paracyclops affinis*, *Eurycercus lamellatus*, *Alonella nana*.

7. Tapolca creek

Measured values of the specific electric conductivity (980–990 µS/cm) indicate alpha-oligohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic $\text{Ca} - \text{HCO}_3$, $\text{Ca} - \text{Mg} - \text{HCO}_3$ and $\text{Ca} - \text{HCO}_3 - \text{SO}_4$ composition. Ionic composition is similar to the water of the Egervíz. Dissolved oxygen contents and COD parameters both indicate slightly polluted water. On the basis of nutrients, the water quality is similar. Due to the benthic eutrophication the measured chlorophyll-*a* concentrations were low.

No planktonic algae or Rotatoria species were observed in any of the samples in June 1997. On other occasions we have found slightly richer fauna, but this was not characteristic to the Hungarian waters. The abundances varied in the range of 40–576 ind./100 liter, which is characteristic to low production waters. Of the identified 13 species 12 Rotatoria and only one Cladocera species were present. Copepoda were not found in plankton. Some newer species were found in the biotecton community such as *Mytilina mucronata*, *Lecane (M) lunaris* and *Lepadella ovalis*.

8. Kétöles creek

Specific electric conductivity varied between 850–1380 µS/cm. According to this the water falls the alpha-oligohalobic- oligo-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic $\text{Ca} - \text{HCO}_3$, and $\text{Ca} - \text{Mg} - \text{HCO}_3 - \text{SO}_4$ content. The water quality of the creek is lower than the previous ones on the basis of the chemical parameters. Pollution is particularly evident in COD contents, while values of dissolved oxygen contents and saturation revealed good water quality. It is possible that the creek experience temporary pollution waves that are indicated by the large fluctuations of the ionic composition of the creek. Quantity of nitrogen- and phosphorus forms is high, on the basis of which the quality is tolerable. It is probable that all these indicate organic pollution, as the highest fluctuations were observed in the ammonium and nitrate concentrations. The chlorophyll-*a* content of the water was relatively higher than in the previous creeks. Maximums were measured during the summer period that were paralleled by the orthophosphate minimums.

Amongst the so far discussed creeks the plankton communities were found to be the richest in this stream. Occurrence of 17 Rotatoria, 6 Cladocera and 5 Copepoda species were recorded. Individual abundance value for 100 liters ranged within wide numbers (92–3016 ind.). Higher

values are characteristic to the eutrophic Hungarian waters. This was quite evidenced by the occurrence of the dominant species: *Brachionus angularis*, *B. quadridentatus quadridentatus*, *B. quadridentatus brevispinus*, *Euchlanis dilatata*, *Keratella cochlearis cochlearis*, *K. c. tecta*, *Chydorus sphaericus*, *Pleuroxus aduncus*, *Acanthocyclops robustus* f. *limnetica*, *Eucyclops serrulatus*, *Macrocyclus albidus*. Apart from the listed species some rare ones also occurred inhabiting the submersed vegetation and biotecton: *Brachionus quadridentatus melheni*, *Lophocharis oxysternon*, *Mytilina ventralis*, *Paradicranophorus hudsoni*, *Testudinella parva*, *Eurycercus lamellatus*, *Oxyurella tenuicaudis*, *Eucyclops speratus*.

9. Világos creek

Specific electric conductivity values were extremely high in this creek in the range of 1480–1890 $\mu\text{S}/\text{cm}$. Minimal value corresponds to oligo-mesohalobic while the maximum value to the beta-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic $\text{Ca} - \text{SO}_4$, $\text{Ca} - \text{Mg} - \text{SO}_4$ and $\text{Ca} - \text{SO}_4 - \text{HCO}_3$ composition. The Világos creek is characterized by the specific electric conductivity value and sulfate content, which indicate high ionic strength of fresh and salt waters. Dissolved oxygen concentrations and COD values are all indicating even worse situation of high pollution. As far as the plant nutrients are concerned the amount of ammonium, nitrate and dissolved orthophosphate were all low and only the total phosphorus concentration was high, indicating polluted state. The chlorophyll-*a* concentrations varied widely in the range of 96.0–98.0 $\mu\text{g}/\text{l}$.

Species composition of the Rotatoria and Crustacea communities was similar to the Kétöles creek, and the magnitude of abundance was almost identical (212–1156 ind./100 liter). Dominant species are characteristic to the slow flowing or stagnant eutrophic surface waters: *Brachionus angularis*, *B. quadridentatus quadridentatus*, *Euchlanis dilatata*, *Lepadella patella*, *Lophocharis oxysternon*, *Ceriodaphnia quadrangula*, *Chydorus sphaericus*, *Acanthocyclops robustus* f. *limnetica*, *Eucyclops serrulatus*. No rare species was found. On the basis of the Rotatoria and Crustacea results the water quality of the creek is moderately polluted, eutrophic.

10. Lesence creek

Minimal value of specific electric conductivity indicate alpha-oligohalobic, and maximal value oligo-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic $\text{Ca} - \text{HCO}_3 - \text{SO}_4$ -, or $\text{Ca} - \text{Mg} - \text{HCO}_3 - \text{SO}_4$ composition. The water quality of the creek is slightly worse than the Világos creek, as the result of the lower dissolved oxygen concentration and oxygen saturation. All of the measured other parameters are almost identical to the values measured on the previous creek. Chlorophyll-*a* contents of the water were showing similar fluctuations as the previously described stream.

Number of Rotatoria and Crustacea taxa was 26, the presence of higher number of (6) Cladocera species is somewhat unexpected. Abundance values were measured to be low in every occasions, in the range of 70–238 ind./100 liters. The possible reason for this is the polluted water, the low oxygen content and lack of nutrients. Beside the already mentioned Rotatoria species the following ones are present in the biotecton: *Cephalodella gibba*, *Trichocerca stylata*, *Trichotria pocillum* and one *Philodina* species. Amongst the Crustacea species the following are aquatic plant surface dwelling: *Alonella nana*, *Ceriodaphnia reticulata*, *Scapholeberis mucronata*, *Simocephalus vetulus* and *Acanthocyclops vernalis*. On the basis of the Rotatoria and Crustacea plankton results this stream is polluted, with dense aquatic vegetation, and slow flow.

11. Zala River

Its water quality is quite different from than of the previously assessed creeks. The specific electric conductivity 90% percentile value is 648 $\mu\text{S}/\text{cm}$, corresponding to alpha-oligothalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic $\text{Mg} - \text{Ca} - \text{HCO}_3$, or $\text{Ca} - \text{Mg} - \text{HCO}_3$ composition. The dissolved oxygen content and COD values are both indicating tolerable water quality. Nitrogen forms were represented in small volume, indicating good water quality. Opposite to this, considerable amount of orthophosphate phosphor and total phosphor was measured. The outlet water of the reservoir usually had low chlorophyll-*a* concentration in the range of 9.6–17.0 $\mu\text{g}/\text{l}$.

Zooplankton studies revealed the occurrence of 21 Rotatoria, 9 Cladocera and 4 Copepoda species. The abundance values were 158–1732 ind./100 liters. Value above one thousand occurred only at one occasion. The number of the dominant species was low (*Brachionus angularis*, *B. quadridentatus quadridentatus*, *B. q. brevispinus*, *Ceriodaphnia quadrangula*, *Chydorus sphaericus*, *Simocephalus vetulus*, *Acanthocyclops robustus* f. *limnetica* and *Eucyclops serrulatus*). Rare species were hardly found (*Lophocharis oxysternon*, *Trichocerca capucina*, *Acroperus harpae*, *Graptoleberis testudinaria*). The low oxygen content and filter feeding zooplankton community reduces the number of the algae (as indicated by the chlorophyll-*a*). This had an adverse effect to the establishment of large zooplankton stands.

12. Nyugati channel

Similar to the Zala River the specific electric conductivity value of the channel was low and varied between 545–695 $\mu\text{S}/\text{cm}$. This indicates beta-alpha-oligothalobic stage -alpha-oligothalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with $\text{Ca} - \text{HCO}_3$ and $\text{Ca} - \text{Mg} - \text{HCO}_3$ composition. The dissolved oxygen concentration, saturation value and COD contents are indicating moderate pollution level. Among the plant nutrients only the nitrate is low, while the ammonium and nitrite, as well as the phosphorus forms indicate polluted water quality. The amount of the chlorophyll-*a* varied from 7.4 to 63.0 $\mu\text{g}/\text{l}$.

The species composition of the Rotatoria and Crustacea communities was rich with high individual abundances. Altogether 66 species were identified from which the dominance of Rotatoria was evident (44 species). Cladocera was represented by 15, while the Copepoda by 7 species. The dominant species are characteristic to the eutrophic Hungarian waters: *Brachionus angularis*, *B. calyciflorus calyciflorus*, *B. c. amphiceros*, *B. c. anuraeiformis*, *Euchlanis dilatata*, *Filinia longiseta*, *F. terminalis*, *Bosmina longirostris*, *Chydorus sphaericus*, *Acanthocyclops robustus* f. *limnetica*, *A. vernalis*. These frequently formed large stands. The abundance values of the three groups varied in the range of 1311–5825 ind./100 liter during the study. These high values are characteristic to hypertrophic fishponds. Apart from the dominant species some rare taxa were also determined: *Beauchampiella eudactylota*, *Brachionus diversicornis homoceros*, *B. falcatus*, *B. quadridentatus cluniorbicularis*, *Euchlanis proxima*, *Hexarthra mira*, *Ptygura melicerta*, *Graptoleberis testudinaria*, *Pleuroxus trigonellus*, *Eucyclops speratus*. These species are predominantly dwelling in dense aquatic vegetation in smaller water bodies. Excessive individual numbers of the zooplankton community were indicating the polytrophic stage of the Nyugati channel.

13. Zichy channel

The specific conductivity value of the channel was 650–1190 $\mu\text{S}/\text{cm}$ corresponding to alpha-oligothalobic-oligo-mesohalobic stage. On the basis of the inorganic ionic composition

the water is within the beta-limno-type with ionic composition predominantly of $\text{Mg} - \text{Ca} - \text{HCO}_3 - \text{SO}_4$, $\text{Mg} - \text{Ca} - \text{SO}_4 - \text{HCO}_3$ and $\text{Ca} - \text{Mg} - \text{HCO}_3 - \text{SO}_4$. The concentration of dissolved oxygen indicated good water quality, into the saturation and COD content revealed highly polluted water quality in the channel. Values varied highly most probably as the function of the discharge of the channel. Concentration of plant nutrients, in spite of the presence of large macrophyta stands remained high and indicates moderate pollution level. Due to the benthic eutrophication processes the chlorophyll-*a* content usually remained small to medium (2.2–32.0 $\mu\text{g/l}$).

Species composition of the Rotatoria and Crustacea communities was also rich in this creek (altogether 46 species), with two population peaks that had lower value than in the Nyugati channel. Individual numbers were 238–2458 for 100 liters. Similar to the previously described waterways the dominant species and rare species are listed here. Interestingly the zooplankton of this creek was not dominated usually by the *Brachionus* genus, only *B. angularis* formed larger stands. Further dominant species were: *Asplanchna priodonta* (predatory), *Euchlanis dilatata*, *Keratella quadrata*, *Mytilina mucronata*, *Polyarthra vulgaris*, *Alona rectangula*, *Chydorus sphaericus*, *Pleuroxus aduncus*, *Acanthocyclops robustus* f. *limnetica*, *Eucyclops serrulatus*. It is worth mentioning that some of the listed species are not planktonic but dwell in the shoreline zone and on the biofilm communities on the higher aquatic plants. The same is true for the rare species of the creek: *Brachionus falcatus*, *B. quadridentatus melheni*, *Collotheca volutata*, *Encentrum* sp. *Lecane stenroosi*, *Acroperus harpae*, *Alona costata*, *Chydorus latus*, *Kurzia latissima*, *Pleuroxus striatus*, *Diacyclops bicuspidatus*. On the basis of the zooplankton results the Zichy creek is a polluted, eutrophic stream with slow-to-stagnant water. Benthic eutrophication is registered.

14. Keleti Bozót creek

The measured specific electric conductivity value of this creek is significantly lower than the previous ones falling to the range of 580–680 $\mu\text{S/cm}$, indicating alpha-oligohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic ionic composition of $\text{Ca} - \text{Mg} - \text{HCO}_3$, $\text{Mg} - \text{Ca} - \text{HCO}_3$. The dissolved oxygen concentration varied widely. COD values indicated tolerable water quality and pollution. Plant nutrient content is small compared to the previous ones only the total phosphorus concentration was higher, indicating tolerable quality. Chlorophyll-*a* content is high in spite of the presence of large macrophyte vegetation stands (15.5–85.0 $\mu\text{g/l}$).

The pollution is more moderate than in the previous creek, but the enriched nutrient content (indicated by the high chlorophyll-*a* concentration) resulted in excessive stands of Rotatoria and Crustacea communities. Individual abundances were high accordingly, 2143–6877 ind./100 liter. As it was mentioned earlier these values are characteristic to fishponds. Species composition is considered to be rich, 30 Rotatoria, 11 Cladocera and 8 Copepoda species were found in the plankton, among these there are euplanktonic as well as tichoplanktonic species. Dominant species were in most of the cases similar to the ones found in the Nyugati channel: *Brachionus angularis*, *B. calyciflorus* (and forms), *B. quadridentatus* (and forms), *Euchlanis dilatata*, *Keratella cochlearis cochlearis*, *Lecane bulla*, *Bosmina longirostris*, *Ceriodaphnia quadrangula*, *Chydorus sphaericus*, *Acanthocyclops robustus* f. *limnetica*, *Eucyclops serrulatus*. Of the rare species *Brachionus rubens* and *Megafenestra aurita* were not found in the previously mentioned streams, but *Brachionus diversicornis homoceros*, *Lecane stenroosi*, *Paradicranophorus* sp., and *Ptygura melicerta* were registered at one-one sampling site. Large zooplankton

stands resulted in hypertrophic water quality classification. Nevertheless, rare species are present and species richness indicate moderate pollution level.

15. E-W channel (Ordacsehi trench)

Specific electric conductivity values were higher than in the previous creek (610–1020 $\mu\text{S}/\text{cm}$), indicating alpha-oligohalobic-oligo-mesohalobic stages. On the basis of the inorganic ionic composition the water is within the beta-limno-type that is characterized by the dominance of $\text{Mg} - \text{Ca} - \text{HCO}_3$, and on one occasion $\text{Mg} - \text{Ca} - \text{HCO}_3 - \text{SO}_4$ ions. Dissolved oxygen content varied widely as evidenced by the fluctuating saturation values (18.9–166.2%). COD values indicate heavy pollution. Due to the high phytomass the plant nutrient content was low. Of the nitrogen forms only the ammonium and from the phosphorus forms only the total phosphorus value were higher, while the rest was low. The chlorophyll-*a* content (14.1–38.0 $\mu\text{g}/\text{l}$) was found to be medium.

Similarly to the previous creek the zooplankton showed rich species composition, 28 Rotatoria, 13 Cladocera and 7 Copepoda taxa were detected. The abundance was extremely high with only one exception (530–12892 ind./100 l), the highest amongst the evaluated streams. Dominant species were similar to those that were identified in the Zichy channel, the *Brachionus* species were represented only by *B. angularis* with large stands. Apart from this the following could be mentioned: *Keratella cochlearis cochlearis*, *K. quadrata*, *Polyarthra vulgaris*, *Pompholyx sulcata*, *Bosmina longirostris*, *Chydorus sphaericus*, *Pleuroxus aduncus*, *Acanthocyclops robustus* f. *limnetica*, *Eucyclops serrulatus*. Some rare taxa occurred here, which were not found in previous streams: *Lophocharis oxysternon*, *Platyas patulus*, *Alona guttata*, *Bosmina coregoni*, *Ceriodaphnia pulchella*, *Daphnia galeata*, *Ectocyclops phaleratus*, *Eucyclops speratus*. The species richness of Cladocera is worth mentioning, most of them is tichoplanktonic species. Due to the very large stands of the zooplankton the water of the creek is hypertrophic, but it does not prevent the occurrence of rare species, and species richness indicates moderate degree of pollution.

16. Jamai creek

Specific electric conductivity value is quite similar to the Ordacsehi trench (630–860 $\mu\text{S}/\text{cm}$), indicating alpha-oligohalobic conditions. On the basis of the inorganic ionic composition the water is within the beta-limno-type with characteristic $\text{Mg} - \text{Ca} - \text{HCO}_3$ – and $\text{Mg} - \text{Ca} - \text{HCO}_3 - \text{SO}_4$ ionic composition. Dissolved oxygen contents and their changes as well as fluctuations in saturation values are similar to the patterns registered at the Ordacsehi trench. Difference emerges in the minimum of the oxygen content, which was slightly higher here. The slightly better water quality is also evidenced by the values of the COD content on the basis of which the water is not heavily polluted, but the water quality of the creek is tolerable. Nutrient concentrations (nitrogen and phosphorus forms), as well as the amount of chlorophyll-*a* is slightly higher than in the previous creek. These values are obviously highly effected by the dense vegetation.

Richest species composition of Rotatoria and Crustacea plankton was found in this stream amongst the investigated ones, 37 Rotatoria, 6 Cladocera and 6 Copepoda taxa were recorded here. The abundances were lower than in the previous creeks, varying between 417–2749 ind./100 liter. Most frequently occurring species are also those mentioned earlier, predominantly species of *Brachionus*, *Keratella*, *Lecane*, *Bosmina*, *Chydorus*, *Acanthocyclops*, and *Eucyclops* formed large populations. No other rare species that was described before occurred at this particular sampling site.

17. ABC channel

Similar to the Ordacsehi-trench this is a heavily polluted creek, as indicated by 90% value of the specific electric conductivity (1265 $\mu\text{S}/\text{cm}$). This corresponds to the alpha-oligo-halobic-oligo-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with $\text{Mg} - \text{HCO}_3$, $\text{Mg} - \text{Ca} - \text{HCO}_3$ and $\text{Mg} - \text{Ca} - \text{HCO}_3 - \text{SO}_4$ ionic composition. The values of the oxygen budget are quite contradictory at this creek. Dissolved oxygen values indicate clean water. The detailed analysis of the saturation value fluctuations, however, does prevail values around 50% indicating moderately good quality and on three occasions significant super-saturation. All of these indicate polluted water quality. This is supplemented by the measured values of the COD content. Nitrogen forms indicate that this is a so-called "fresh pollution" as the ammonium content of the creek is significant. Nitrite and nitrate concentrations indicate good water quality. Phosphorus content was found to be high. Chlorophyll-*a* did show large fluctuations, varied between 3.7–84.0 $\mu\text{g}/\text{l}$. Opposite to previous creeks planktonic eutrophication was observed here.

Due to the more polluted character of the water in the channel the zooplankton community was poorer than the previous streams, only 24 Rotatoria, 8 Cladocera and 5 Copepoda species were found. Individual abundance values were between 686–7586 ind./100 liter. The large populations of *Brachyonus calyciflorus calyciflorus* and *Polyarthra vulgaris* in June 1997 caused the latter high value, in this sample only 13 taxa were found. During the investigations smaller individual numbers were measured. Analysis of the species composition revealed that the genera of *Brachionus*- and *Keratella* are the richest. It seems that these species better tolerate organic pollution and the increased saprobic state. Therefore these are good indicators of these processes. Of the rare species the occurrence of *Alona costata* (Cladocera) is worth mentioning. The Rotatoria and Crustacea community of the channel is poor. Single species are representing large individual numbers. These two factors together indicate heavily polluted stream.

18. Tetves creek

The specific electric conductivity varied between 730 and 950 $\mu\text{S}/\text{cm}$ indicating alpha-oligo-halobic conditions. On the basis of the inorganic ionic composition the water is within the beta-limno-type with $\text{Mg} - \text{Ca} - \text{HCO}_3$ and $\text{Ca} - \text{Mg} - \text{HCO}_3$ ionic dominances. Dissolved oxygen content and saturation values showed similar dynamics and similar values to the ones measured in the ABC channel. In this situation the presence of similar pollutants and planktonic eutrophication is the key factor, therefore the water is heavily polluted. The same is evidenced by the measured value of the COD concentrations. No significant difference was observed between the phosphorus and nitrogen forms, all of them indicate slight pollution state.

High species number zooplankton communities were found in the stream that was classified as heavily polluted on the basis of the oxygen budget parameters. This is supported by the presence of some 31 Rotatoria, 9 Cladocera and 5 Copepoda taxa. Individual abundance values varied between 317–6979 ind./100 liter with peaks at two occasions. Dominant species were, apart from the previously mentioned *Brachionus* and *Keratella* species, *Euchlanis dilatata*, *Bosmina longirostris*, *Chydorus sphaericus*, *Disparalona rostrata* and *Eucyclops serrulatus*. From saprobiological indication viewpoint it could be interesting that the latter species are always found in moderately and heavily polluted waters. In addition to the previously mentioned two species of the previous creek, these could be the indicators of organic pollution. There are some taxa not found in previous streams: *Notommata* sp., *Polyarthra major*, *Trichocerca elongata*, *T. similis*, *Trichotria pocillum*. The species rich zooplankton community of this creek is particularly characterized by the occurrence of organic pollution tolerant species.

These are among the Rotatoria and Crustacea as well. In saprobiological evaluation these species could serve for the indication of higher organic concentrations.

19. Nagymetszés trench

Less polluted water than the previous one in spite of the fact that specific electric conductivity value is somewhat higher 820–1040 $\mu\text{S}/\text{cm}$, referring to alpha-oligohalobic-oligo-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with ionic dominance of $\text{Ca} - \text{Mg} - \text{HCO}_3$ and $\text{Mg} - \text{Ca} - \text{HCO}_3$. The parameters of oxygen budget also indicate better water quality as evidenced by the smaller fluctuations. On the basis of the measured COD values the water is moderately polluted. Among the nitrogen forms the ammonium and nitrate concentrations are lower, while the nitrite, orthophosphate phosphor and total phosphorus indicate worse water quality. Chlorophyll-*a* content was found to be usually low (1.5–14.1 $\mu\text{g}/\text{l}$), with the exception of a November measurement when 61.0 $\mu\text{g}/\text{l}$ value was determined.

Rotatoria and Crustacea communities are similar in species composition and abundance value to the Tetves creek. Altogether 34 species were found during the survey. Abundance value varied between 332–2984 ind./100 liter. The two largest and the two smallest value were found at identical sampling time. Dominant and rare species were also similar, of the latter category the *Bosmina coregoni* could be mentioned. Similarly to the previous creek species-rich zooplankton communities were characteristic here. Predominately the abundance of organic pollution tolerant species was observed.

20. Kőröshegyi creek

Similarly to the previously described ones the water of the creek is heavily polluted. This is indicated by the high values of conductivity between 945–1170 $\mu\text{S}/\text{cm}$. This range corresponds to the alpha-oligohalobic-oligo-mesohalobic stages. On the basis of the inorganic ionic composition the water is within the beta-limno-type with ionic dominance of $\text{Ca} - \text{Mg} - \text{HCO}_3$ and $\text{Mg} - \text{Ca} - \text{HCO}_3$. Among the oxygen *budget* parameters the oxygen saturation indicates the presence of organic pollutants which exceeded only at one occasion the 100% value. Similar water quality class is established on the basis of the dissolved oxygen content. COD values indicate tolerable pollution level. The elevated ammonium, nitrite and phosphorus characterize nutrient contents while the nitrate was less. All of these parameters indicate heavy pollution.

Results of the water chemistry analyses indicate high organic pollutant levels. This is quite evident from the results of the zooplankton community species composition and abundance values as well. Both the high taxon number (43), and the large populations and in presence of Copepoda (2) species all indicate the high trophic state of the creek. Abundance values were measured between 1553–3173 ind./100 liter, but opposite to the previous creek this high value prevailed in each occasions. This also indicated planktonic eutrophication, characteristic of the eutrophic stage. Dominant species were represented by the *Brachionus*-genus with 10 species, while the *Keratella* with 5 species. Large amounts of the already mentioned Rotatoria and Crustacea species, tolerant to organic pollution, were found here. Rare species were represented by some new species (*Keratella testudo*, *K. tropica*, *Mytilina bisulcata*), not found in the previously described streams. On the basis of the results of the zooplankton community investigations this creek is from moderately to heavily polluted, with high saprobic stage.

21. Endrédi creek

The discharge of the creek was highly fluctuating, therefore investigations could only be conducted during 1998. Results should be considered as preliminary ones. Even the lower amount of measurement was enough to determine that water of the creek is polluted. This was evidenced by the measured high conductivity value ranging from 1120 to 1290 $\mu\text{S}/\text{cm}$. These values correspond to oligo-mesohalobic stage. On the basis of the inorganic ionic composition the water is within the beta-limno-type with ionic dominance of $\text{Ca} - \text{Mg} - \text{HCO}_3$ and $\text{Mg} - \text{Ca} - \text{HCO}_3$. Dissolved oxygen content and saturation values indicate pollution. This is supported by the values of the COD content that are characteristic of heavily polluted surface waters. The ammonium and nitrate content was less while the nitrite was slightly higher. Phosphorus concentrations indicated heavily polluted water.

Zooplankton study was conducted only once here, therefore results have to be considered as preliminary ones, for faunistic purposes. Altogether 8 species were identified from which only one *Proales* sp. (Rotatoria) is worth mentioning while the rest of the species is characteristic to small, eutrophic surface waters.

Summary

On the basis of oxygen and nitrogen-, and phosphorus budget parameters among the creeks on the Northern shore the water of the Csopaki creek is slightly polluted. The Vörösberényi creek, the Lovasberényi creek, the Örvényesi creek, the Burnót creek, the Egervíz and the Tapolca creek have tolerable water quality, while the Kétöles creek is heavily polluted. Species composition of the zooplankton communities is in general poor in these streams with low individual abundance. In many cases the samples contained drifting animals from the biotecton characteristic to meso- and eutrophic stagnant water taxa.

The water quality of the Világos creek, Lesence creek, Zala River and Nyugati channel is significantly worse, indicating polluted conditions. In some cases (e.g., Világos creek, Lesence creek) oxygen budget parameters were indicating even worse conditions, of heavily polluted state. Zooplankton communities of the latter streams were usually richer with higher abundance. In these creeks the reason for the bad water quality is the not suitable water exchange, as long-term small water periods are experienced.

Water quality of the Zala River is determined by the water quality of the outlet water of the Kis-Balaton II. phase at the Fenékpusztá section. On this short section of the river the dissolved oxygen is very low with elevated phosphorus concentration. Of the creeks of the southern shore the Zichy channel, Kelet-Nyugati channel, the ABC channel and the Tetves creek are heavily polluted. Their water indicates eu- and polytrophic state as characterized by the large zooplankton stands. On the basis of the water chemical parameters the organic pollution is high in these waters. Slow flowing regime makes the situation even worse.

The water quality is slightly better, tolerable in creeks that are densely populated by macrophyte vegetation (such as the Keleti Bozót channel, Jamai creek, Nagymetszés trench, Kőröshegyi creek). Dominant species of the zooplankton community of these streams are characteristic to taxa occurring in eutrophic stagnant waters and fishponds. Species number of these streams is much higher than those creeks on the northern shoreline due to the elevated level of plant nutrients. Rare species are quite frequently recorded in these streams.

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Presence of Rotatoria and Crustacea taxa

Taxa	Sampling sites																				
Rotatoria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
<i>Anuraeopsis fissa</i> (Gosse)								+				+			+	+				+	
<i>Ascomorpha ecaudis</i> (Perty)										+					+			+			
<i>Asplanchna brightwelli</i> (Gosse)												+	+	+							
<i>A. priodonta</i> (Gosse)	+											+	+	+	+	+	+	+	+	+	+
<i>Bdelloidea</i> sp.	+	+	+			+		+	+	+	+	+	+		+	+	+	+			
<i>Beauchampiella eudactylota</i> (Gosse)							+					+									+
<i>Brachionus angularis</i> Gosse	+			+	+	+	+	+	+		+	+	+	+	+	+	+	+	+	+	+
<i>B. budapestinensis</i> Daday											+		+								+
<i>B. calyciflorus calyciflorus</i> (Pallas)									+		+	+	+	+		+	+	+	+	+	+
<i>B. c. ampiceros</i> Ehrb.											+										
<i>B. c. anuraeiformis</i> (Brehm)												+		+		+		+		+	
<i>B. c. spinosus</i> (Wierzejski)												+	+								
<i>B. diversicornis</i> (Daday)												+		+	+	+					
<i>B. d. homoceros</i> Wierzejski												+		+							+
<i>B. falcatus</i> Zacharias												+	+								
<i>B. leydigi tridentatus</i> (Sernov)												+			+		+	+	+		+
<i>B. q. quadridentatus</i> (Hermann)				+		+		+	+		+	+	+	+	+	+	+	+	+	+	+
<i>B. q. brevispinus</i> (Ehrb.)							+				+	+	+	+	+	+	+	+	+	+	+
<i>B. q. cluniorbicularis</i> (Skorikov)												+		+	+	+					
<i>B. q. melheni</i> (Barrois et Daday)								+			+		+			+					+
<i>B. rubens</i> Ehrb.		+												+	+	+					
<i>B. urceolaris</i> O.F.M.								+	+			+	+	+	+	+	+	+	+	+	+
<i>Cephalodella gibba</i> (Ehrb.)							+			+					+	+	+	+	+	+	+
<i>Collotheca volutata</i> Sebestyén et Varga													+								
<i>Dicranophorus forcipatus</i> (O.F.M.)												+									
<i>Elosa worallii</i> Lord												+			+						
<i>Encentrum</i> sp.												+									
<i>Euchlanis dilatata</i> Ehrb.	+	+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>E. proxima</i> Myers												+	+	+	+			+			
<i>Filinia longiseta</i> (Ehrb.)												+	+					+		+	
<i>Filinia terminalis</i> (Plate)												+								+	
<i>Hexarthra mira</i> (Hudson)												+				+				+	
<i>Keratella cochlearis cochlearis</i> (Gosse) +	+			+	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+
<i>K. c. tecta</i> (Gosse)			+	+	+	+						+		+		+	+	+	+	+	+
<i>K. quadrata</i> (O.F.M.)	+	+	+	+	+	+	+	+	+	+	+	+	+	+		+	+	+	+	+	+
<i>K. testudo</i> (Ehrb.)			+																	+	
<i>K. tropica</i> Apstein																				+	
<i>Lecane bulla</i> (Gosse)			+			+					+	+	+	+		+	+	+	+	+	+
<i>L. closterocerca</i> (Schmarda)	+							+				+	+	+	+	+	+	+	+	+	+
<i>L. flexilis</i> (Gosse)																				+	
<i>L. luna</i> (O.F.M.)				+				+		+	+	+			+			+			
<i>L. (M.) lunaris</i> (Ehrb.)						+	+		+			+		+	+	+	+	+	+	+	+
<i>L. stenroosi</i> (Meissner)														+		+				+	
<i>L. unguolata</i> (Gosse)														+							
<i>Lepadella ovalis</i> (O.F.M.)		+				+	+			+		+				+			+		
<i>L. patella</i> (O.F.M.)				+				+	+	+	+	+	+			+	+	+	+	+	+
<i>Lophocharis oxysternon</i> (Gosse)								+	+	+	+	+	+		+	+	+			+	
<i>Mytilina bisulcata</i> (Lucks)																				+	
<i>M. mucronata</i> (O.F.M.)						+	+		+	+	+	+	+	+	+	+	+	+	+	+	+
<i>M. ventralis</i> (Ehrb.)								+							+	+	+				
<i>Notholca acuminata</i> (Ehrb.)				+													+	+			+
<i>N. squamula</i> (O.F.M.)	+	+	+	+			+	+			+	+								+	
<i>Notommata</i> sp.																			+		

Taxa	Sampling sites																				
Rotatoria	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
<i>Paradiceranophorus hudsoni</i> (Glascont)						+		+													
<i>Paradiceranophorus</i> sp.															+		+	+			
<i>Philodina</i> sp.										+											
<i>Platyas patulus</i> (O.F.M.)		+													+						
<i>P. quadricornis</i> (Ehrb.)		+									+	+	+			+				+	
<i>Polyarthra major</i> (Bruckhardt)																			+	+	
<i>P. vulgaris</i> Carlin		+				+			+	+	+	+	+	+	+	+	+	+	+	+	
<i>Pompholyx complanata</i> Gossre						+						+			+		+	+	+	+	
<i>Pompholyx sulcata</i> Hudson															+	+					
<i>Proales</i> sp.											+										+
<i>Ptygura melicerta</i> (Ehrb.)						+					+		+							+	
<i>Rotaria</i> sp.							+		+						+				+	+	
<i>Synchaeta pectinata</i> Ehrb.												+			+	+	+	+	+	+	
<i>Testudinella parva</i> (Ternetz)				+				+								+					
<i>T. patina</i> (Hermann)			+				+	+	+	+	+	+	+	+	+	+	+	+	+	+	
<i>Trichocerca capucina</i> (Wierzejski & Zacharias)												+									
<i>T. elongata</i> (Gosse)																		+	+		
<i>T. pusilla</i> (Lauterborn)										+	+										
<i>T. similis</i> (Wierzejski)												+				+		+			
<i>T. stylata</i> (Gosse)									+	+											
<i>Trichotria pocillum</i> (O.F.M.)									+	+	+				+	+	+	+	+	+	
<i>T. tetractis</i> (Ehrb.)												+									
Cladocera																					
<i>Acroperus harpae</i> (Baird)										+		+									
<i>Alona costata</i> Sars											+						+				
<i>A. guttata</i> Sars																+					
<i>A. quadrangularis</i> (O.F.M.)												+		+			+				
<i>A. rectangula</i> Sars		+					+	+	+			+	+	+	+			+		+	
<i>Alonella nana</i> (Baird)						+			+							+		+	+		
<i>Bosmina coregoni</i> Baird																+			+		
<i>B. longirostris</i> (O.F.M.)			+						+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Ceriodaphnia pulchella</i> Sars																+					
<i>C. quadrangula</i> (O.F.M.)			+						+	+	+			+	+		+	+	+		
<i>C. reticulata</i> (Jurine)									+	+											
<i>Chydorus latus</i> Sars												+						+			
<i>C. ovalis</i> Kurz		+																			
<i>C. sphaericus</i> (O.F.M.)	+	+	+	+		+		+	+	+	+	+	+	+	+	+	+	+	+	+	+
<i>Daphnia galeata</i> Sars em. Richard		+														+	+				
<i>D. hyalina</i> Leydig		+	+												+					+	
<i>Disparalona rostrata</i> (Koch)								+			+	+	+	+			+	+	+		
<i>Eurycercus lamellatus</i> (O.F.M.)						+		+													
<i>Graptoleberis testudinaria</i> (Fischer)										+	+										
<i>Iliocryptus agilis</i> Kurz																				+	
<i>I. sordidus</i> (Liévin)															+	+					
<i>Kurzia latissima</i> (Kurz)														+							
<i>Leydigia acanthocercoides</i> (Fischer)														+							
<i>L. leydigi</i> (Schoedler)		+									+										
<i>Macrothrix hirsuticornis</i>																					
Norman et Brady					+					+											
<i>Moina micrura</i> Kurz											+										
<i>Oxyurella tenuicaudis</i> (Sars)								+													
<i>Pleuroxus aduncus</i> (Jurine)								+	+	+	+	+	+	+	+	+		+	+		
<i>P. striatus</i> Schoedler													+								
<i>P. trigonellus</i> (O.F.M.)												+									

Taxa	Sampling sites																				
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
Cladocera																					
<i>Pseudochydorus globosus</i> (Baird)													+								
<i>Scapholeberis aurita</i> (Fischer)												+		+							
<i>S. mucronata</i> (O.F.M.)				+						+		+	+		+		+				
<i>Simocephalus vetulus</i> (O.F.M.)		+							+	+	+	+	+	+	+	+	+	+	+	+	+
Copepoda																					
<i>Acanthocyclops robustus</i>																					
<i>f. limnetica</i> (Sars)		+							+	+	+	+	+	+	+	+	+	+	+	+	+
<i>A. vernalis</i> (Fischer)		+								+		+		+				+			
<i>Cyclops strenuus</i> Fischer														+	+		+	+		+	
<i>Diacyclops bicuspidatus</i> (Claus)													+	+							
<i>Ectocyclops phaleratus</i> (Koch)															+	+					
<i>Eucyclops serrulatus</i> (Fischer)		+		+					+	+	+	+	+	+	+	+	+	+	+	+	+
<i>E. speratus</i> (Lilljeborg)							+		+	+			+	+	+	+				+	
<i>Macrocyclus albidus</i> (Jurine)		+							+	+		+	+	+	+	+	+	+	+	+	+
<i>Megacyclus viridis</i> (Jurine)													+								
<i>Mesocyclops leuckarti</i> (Claus)									+	+	+		+			+	+	+		+	
<i>Paracyclus affinis</i> (Sars)							+														
<i>Thermocyclops crassus</i> (Fischer)											+	+		+							
<i>T. oithonoides</i> (Sars)														+			+				
Total:	9	21	11	12	5	20	13	27	24	27	31	67	48	48	49	48	38	44	35	47	8